Amendments to the Claims

Claims 1-79 (previously cancelled)

Claim 80 (previously added): A femoral head comprising:

a sintered polycrystalline diamond compact,

a substrate located on said polycrystalline diamond compact,

solvent-catalyst metal located in said substrate,

a diamond table sintered to said substrate,

a gradient transition zone between said substrate and said diamond table in said polycrystalline diamond compact, said gradient transition zone having a substrate side and a diamond table side, said gradient transition zone having both solvent-catalyst metal and diamond therein, and said gradient transition zone exhibiting a transition of ratios of percentage content of solvent-catalyst metal to diamond from one side of said gradient transition zone to another such that at a first point in said gradient transition zone near said substrate side, the ratio of percentage content of solvent-catalyst metal to diamond is greater than it is at a second point in said gradient transition zone closer to said diamond side than said first point,

chemical bonds between said diamond table and said substrate which tend to secure said diamond table to said substrate, and

a sintered polycrystalline diamond load bearing and articulation surface on said polycrystalline diamond compact, said sintered polycrystalline diamond load bearing and articulation surface including polycrystalline diamond, said sintered polycrystalline diamond load bearing and articulation surface being formed to present a shape that is at least partially convex spherical;

wherein diamond in said sintered polycrystalline diamond compact has a coefficient of thermal expansion CTE_{Cd}, and wherein said substrate has a coefficient of thermal expansion CTE_{sub}, and wherein CTE_{Cd} is not equal to CTE_{sub}, wherein said diamond in said polycrystalline diamond compact has a modulus $M_{Cd,}$ and wherein said substrate in said polycrystalline diamond compact has a modulus M_{sub}, and wherein $M_{Cd,}$ is not equal to M_{sub}.

Claim 81 (previously added): A head as recited in claim 80 further comprising a mechanical grip between said diamond table and said substrate, said mechanical grip tending to secure said diamond table to said substrate.

Claim 82 (previously added): A head as recited in claim 80 further comprising interstitial spaces in said diamond table.

Claim 83 (previously added): A head as recited in claim 82 further comprising solvent-catalyst metal located in said diamond table interstitial spaces.

Claim 84 (previously added): A head as recited in claim 80 further comprising a residual stress field in said polycrystalline diamond compact that tends to enhance the strength of said polycrystalline diamond compact.

Claim 85 (previously added): A head as recited in claim 80 further comprising a crystalline diamond structure in said diamond table.

Claim 86 (previously added): A head as recited in claim 80 wherein said polycrystalline diamond compact is polished to an Ra value of between about 0.5 to about 0.005 microns.

Claim 87 (previously added): A head as recited in claim 80 wherein said substrate includes a plurality of metals.

Claim 88 (previously added): A head as recited in claim 80 wherein said substrate includes a metal alloy selected from the group consisting of titanium, titanium aluminum and vanadium, titanium molybdenum hafnium, titanium and nitinol, cobalt chrome, cobalt chrome molybdenum, cobalt chrome tungsten, cobalt chrome cemented tungsten carbide, cobalt chrome cemented chrome carbide, fused silicon carbide and stainless steel.

Claim 89 (previously added): A head as recited in claim 80 further comprising a first substrate layer and a second substrate layer.

Claim 90 (previously added): A head as recited in claim 89 wherein said first substrate layer includes at least one metal not found in said second substrate layer.

Claim 91 (previously added): A head as recited in claim 89 further comprising a barrier layer between said first and second substrate layers.

Claim 92 (previously added): A head as recited in claim 80 wherein in said polycrystalline diamond compact diamond table, at least two different sizes of diamond crystals are found.

Claim 93 (previously added): A head as recited in claim 80 further comprising substrate surface topographical features on said substrate.

Claim 94 (previously added): A head as recited in claim 80 wherein said sintered polycrystalline diamond load bearing and articulation surface has an Ra value of between about 0.5 to about 0.005 microns.

Claim 95 (previously added): A head as recited in claim 80 wherein said sintered polycrystalline diamond load bearing and articulation surface is burnished.

Claim 96 (previously added): A femoral head comprising:

a metal substrate,

a diamond table,

said substrate and said diamond table forming a sintered polycrystalline diamond compact,

a zone between said substrate and said diamond table that has a composition gradient of decreasing solvent-catalyst metal content across said zone,

chemical bonds in said zone, said chemical bonds including diamond-to-diamond bonds in said diamond table, diamond-to-metal bonds in said gradient transition zone, and metal-to-metal bonds in said solvent-catalyst metal,

at least some of said bonds being sp3 carbon bonds,

a mechanical grip between said diamond table and said substrate which tends to secure said diamond table to said substrate,

said mechanical grip being achieved at least in part by residual stresses between said substrate and said diamond table,

interstitial spaces in said diamond table,

solvent-catalyst metal present in said interstitial spaces, and

a non-planar sintered polycrystalline diamond load bearing and articulation surface formed by said diamond table,

said non-planar sintered polycrystalline diamond load bearing and articulation surface serving to permit articulation of the femoral head in a human body.

Claim 97 (currently amended): A femoral head as recited in claim [97] 96 wherein sintered diamond in said diamond table has a coefficient of thermal expansion CTE_{Cd}, and wherein said substrate has a coefficient of thermal expansion CTE_{sub}, and wherein CTE_{Cd} is not equal to CTE_{sub}.

Claim 98 (currently amended): A femoral head as recited in claim [97] 96 wherein said sintered diamond in said diamond table has a modulus $M_{Cd,}$ and wherein said substrate has a modulus M_{sub}, and wherein $M_{Cd,}$ is not equal to M_{sub}.

Claim 99 (currently amended): A femoral head as recited in claim [97] 96 further comprising a residual stress field that tends to enhance the strength of attachment of said diamond table to said substrate.

Claim 100 (currently amended): A femoral head as recited in claim [97] 96 further comprising substrate surface topographical features on said substrate.

Claim 101 (currently amended): A femoral head as recited in claim [97] 96 wherein said substrate includes a metal alloy with at least one femoral head of said metal alloy being selected from the group consisting of titanium, aluminum, vanadium, molybdenum, hafnium, nitinol, cobalt, chrome, molybdenum, tungsten, cemented tungsten carbide, cemented chrome carbide, fused silicon carbide, nickel, tantalum, and stainless steel.

Claim 102 (currently amended): A femoral head as recited in claim [97] 96 wherein diamond table comprises diamond feedstock that has diamond particles that have a dimension in the range of less than about 1 nanometer to more than about 100 microns.

Claim 103 (currently amended): A femoral head as recited in claim [97] 96 wherein said sintered polycrystalline diamond load bearing and articulation surfaces is a continuous diamond surface.

Claim 104 (currently amended): A femoral head as recited in claim [97] 96 wherein said sintered polycrystalline diamond load bearing and articulation surface is a discontinuous diamond surface.

Claim 105 (currently amended): A femoral head as recited in claim [97] 96 wherein said sintered polycrystalline diamond load bearing and articulation surface is a segmented diamond surface.

Claim 106 (currently amended): A femoral head as recited in claim [97] 96 wherein a lip is present on said substrate in order to mechanically interlock said diamond table to said substrate.

Claim 107 (currently amended): A femoral head as recited in claim [97] 96 further comprising CoCr solvent-catalyst metal in said diamond table interstitial spaces.

Claim 108 (currently amended): A femoral head as recited in claim [97] 96 further comprising a continuous gradient in said diamond table.

Claim 109 (currently amended): A femoral head as recited in claim [97] 96 further comprising an incremental gradient in said diamond table.

Claim 110 (currently amended): A femoral head as recited in claim [64] 109 wherein said incremental gradient includes a plurality of strata in said diamond table, a first of said strata having characteristics which differ from those of a second strata.

Claim 111 (currently amended): A femoral head as recited in claim [65] 110 wherein said differing characteristics of said strata are selected from the group consisting of diamond particle size, diamond particle distribution, and solvent-catalyst metal content.

Claim 112 (currently amended): A femoral head as recited in claim [97] 96 further comprising an interface gradient.

Claim 113 (currently amended): A femoral head as recited in claim [97] 96 wherein said diamond table has a thickness of from less than about 1 micron to more than about 3000 microns.

Claim 114 (Previously added): A femoral head comprising:

a substrate,

a diamond table sintered to said substrate,

said substrate and diamond table forming a sintered polycrystalline diamond compact,

a zone that includes both sintered diamond and substrate, said zone having a composition gradient of solvent-catalyst metal content to diamond content, said gradient being selected from the group consisting of interface gradient, continuous gradient and incremental gradient,

chemical bonds in the femoral head, said chemical bonds including diamond-to-diamond bonds in said diamond table, diamond-to-metal bonds in said zone, and metal-to-metal bonds in said solvent-catalyst metal,

a mechanical grip between said diamond table and said substrate which tends to secure said diamond table to said substrate, and

a non-planar load bearing and articulation surface formed by said diamond table.

Claim 115 (currently amended): A femoral head as recited in claim [116] 114 wherein at least some of said bonds are sp3 carbon bonds.

Claim 116 (currently amended): A femoral head as recited in claim [116] 114 wherein said diamond table includes a plurality of strata such that a first of said strata having characteristics which differ from those of a second strata.

Claim 117 (currently amended): A femoral head as recited in claim [118] 116 wherein said differing characteristics are selected from the group consisting of diamond particle size, diamond particle distribution, and solvent-catalyst metal content.

Claim 118 (currently amended): A femoral head as recited in claim [116] 114 wherein said diamond table has been formed using CoCr as a solvent-catalyst metal.

Claim 119 (currently amended): A femoral head as recited in claim [116] 114 wherein said diamond table presents a non-planar sintered polycrystalline diamond load bearing and articulation surface.

Claim 120 (currently amended): A femoral head as recited in claim 114 further comprising interstitial spaces located in said diamond table, and solvent-catalyst metal located in said interstitial spaces.

Claim 121 (currently amended): A femoral head as recited in claim [116] 114 further comprising interstitial spaces in said diamond table; wherein said interstitial spaces are at least partially filled with a metal.

Claim 122 (currently amended): A femoral head as recited in claim [123] 121 wherein said interstitial spaces are filled with solvent-catalyst metal.